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NOTES ON NEW OR RARE SPECIES OF RUSTS

W. H. LONG

This paper describes four new species of rusts, namely, *Gymnosporangium cupressi* on *Cupressus arizonica*, *Ravenelia subtortuosae* on *Acacia subtortuosa*, *Ravenelia gooddingii* on *Acacia suffrutescens*, and *Ravenelia cassiae-covesii* on *Cassia covesii*, and gives new data as to hosts and distribution of two other species of *Ravenelia*.

Gymnosporangium cupressi Long and Goodding, sp. nov.

I. Aecia unknown.

III. Telia caulicolous, from a perennial mycelium, appearing on twigs, branches, and trunks, causing fusiform to subglobose swellings 1–90 cm. long by 0.5–30 cm. thick, usually breaking forth irregularly and often transversely on the smaller branches and twigs, in irregular rows in deep longitudinal fissures of the bark on the larger branches and trunks. When mature, telia are more or less wedge-shaped, often irregular and somewhat crenate at top, before gelatinization 2–10 mm. broad by 4–6 mm. tall, dark chestnut brown, becoming cinnamon brown after expansion; teliospores 2-celled, spores with colored walls, oval to ellipsoid, $22–27 \times 43–50\ \mu$, average for ten spores $24.2 \times 49\ \mu$, slightly or not at all constricted at the septum, the two cells subequal, pedicel cylindrical, pores two in each cell near septum, walls $2–3\ \mu$ thick; teliospores with thin, colorless walls, oblong to narrowly ellipsoid, not constricted at septum, $16–20 \times 40–60\ \mu$, average for ten spores $18.6 \times 53\ \mu$, the two cells subequal, spores rounded at both ends, pores two in each cell at the septum, walls $1–1.5\ \mu$ thick.

On Juniperaceae. Type collected on *Cupressus arizonica*, at Snebly Hill, 3.5 miles from Sedona, Arizona, May 26, 1920, by *Leslie N. Goodding* (no. 6906 Long); also collected on same host and in same locality in 1919 by *Goodding* (no. 6903 Long). Collected on same host on road between Cottonwood and Sedona, 6 miles from Sedona, May 26, 1920, by *Goodding* (no. 6904 Long). This fine species of *Gymnosporangium* is probably generally distributed on this host in the draws and canyons around Sedona at an elevation of about 4000 ft.

Ravenelia subtortuosae, sp. nov.

o. Pycnia; none found in material at hand.

I. Aecia caulicolous, thickly scattered over hypertrophied areas which form open witches' brooms 1–2 cm. across. Aecia 0.2–0.3 mm. in diameter by 0.8–1.2 mm. high, cylindrical, subepidermal, peridium erect, margin erose and gradually weathering away to base, cells irregularly oblong to polygonal in face view, not overlapping, outer walls 5–6 μ thick, verrucose, inner ones 2–3 μ thick, verrucose, both walls appearing as if reticulate in certain views, side walls 2–3 μ thick, transversely striate; aeciospores irregularly oval to subglobose, angular, 13–18×18–23 μ, average for ten spores 17×19.6 μ, walls cinnamon brown, 2–3 μ thick, minutely verrucose.

II. Uredinia amphigenous, very small, less than 0.3 mm. across, rather firm, punctiform, subepidermal, ruptured epidermis inconspicuous; urediniospores obovate, subpyriform to oval, 15–22×22–30 μ, average for twenty spores 17.3×25.7 μ, chestnut brown, concolorous, or sometimes slightly darker at apex, walls 1.5–2 μ thick, uniform, verrucose, germ pores six, equatorial; paraphyses very abundant, often constituting one-third to one-half of sorus, hyphoid, incurved, chocolate brown, dense, encircling the sorus, 10–13×40–50 μ, average for ten 10.3×43.6 μ, an occasional paraphysis clavate, nearly colorless and with a solid stipe.

III. Telia amphigenous, oval, 0.5–1 mm. across, chestnut brown, subepidermal, ruptured epidermis inconspicuous, early naked; paraphyses none; teliospore heads light brown, hemispherical to ovoid, very irregular in shape and size, 33–100 μ, average for forty heads 52.5 μ, 3–6 spores across, marginal spores 3–16, inner spores 0–12, spores in head 3–32, usual number 14–25, smooth, outer spores 1-celled, inner ones 2-celled; cysts small, hyaline, subappressed, ovoid, as many as the marginal spores, cohering at sides to each other but not to stipe, swelling and bursting in water; pedicel hyaline, compound, deciduous, short, 32–55 μ long.

On Mimosaceae. Type for aecia collected on *Acacia subtortuosa* at Corpus Christi, Texas, May 25, 1918, by *W. H. Long* (no. 6506). Type for uredinia and telia collected on same host and in same locality June 25, 1920, by *Long* (no. 6891); also collected at Darling, Texas, on same host June 19, 1920, by *Long* (no. 6892).

The aecial stage of this *Ravenelia* is very conspicuous, while the other two stages are just the reverse. In fact, to find the uredinia and telia one must look on the leaves immediately adjacent to the aecial stage. At Darling, a flag station about 12 miles from Spofford Junction, the old witches' brooms of this *Ravenelia* were very abundant for about 1 mile along the railroad track. Often some bushes would have from fifteen to twenty-five "brooms." An occasional urediniospore was found intermixed with the telia in the Darling material.

In the 1918 collection aecia and telia were found. The telia were very rare, only a few sori to each bush. In the 1920 material collected in the same catclaw-mesquit field, an abundance of both uredinia and telia were found associated directly with the old witches' brooms. The uredinia were found on bushes growing in low damp spots with branches dense and close to the ground. On account of the abundance of the uredinia and telia in the 1920 material this collection was made the type of these two stages.

The uredinial stage of *Ravenelia subtortuosae* bears a close resemblance in all of its characters to the same stage of *R. australis* (as it occurs in Texas), even to the paraphyses, but differs materially in its telia from this species. *R. subtortuosae* is also related to *R. MacOwaniana,* found in south and central Africa on *Acacia horrida*, but differs from this species in many important characters.

This is the only *Ravenelia* known to the writer reported from the Americas that has the three stages, aecia, uredinia, and telia.

Ravenelia gooddingii, sp. nov.

o. Pycnia unknown.

II. Uredinia small, sparse (in material examined), hypophyllous, scattered, subcuticular, early naked, cinnamon brown; paraphyses very abundant, intermixed with the spores or in separate sori, subcylindrical to narrowly clavate, a few obovate, clavate type with thick walls and nearly solid heads, upper one-half to two-thirds of head fulvous, balance hyaline or nearly so, stipe solid, hyaline, 10–14 by 40–50 μ, obovate type thin-walled, subhyaline, with apex sometimes slightly thickened and fulvous, 15–18 × 30–55 μ; urediniospores broadly oval to globoid, 12–16 × 16–19 μ, walls pale fulvous, thin, 1–1.5 μ, verruculose, pores 6–8, scattered.

III. Telia amphigenous, but mainly hypophyllous, often seated on pallid spots, usually found on basal half of the leaves, very irregular, 0.5–1.5 mm. × 2–4 mm. long, often confluent over one-half to two-thirds of the leaf, subcuticular, early naked, shining, chocolate brown, ruptured cuticle inconspicuous; paraphyses none, teliospore heads light chestnut brown, 5–6 cells across, 60–80 μ, average for twenty heads 70.3 μ, 8–16 marginal cells, 8–18 inner ones, heads more or less flattened, smooth; cysts hyaline, in two rows beneath the entire head, appressed, not cohering, oval to obovate, easily swelling and bursting in water; pedicel short, hyaline, deciduous.

On Mimosaceae. Type collected on *Acacia suffrutescens* in Baboquivari Mountains, Arizona, October 24, 1919, by *Leslie N. Goodding* (no. 6983 Long).

Ravenelia cassiae-covesii Long and Goodding, sp. nov.

0. Pycnia unknown.

II. Uredinia amphigenous, scattered, round or irregular, 1–2 mm. across, subcuticular, early naked, cinnamon brown, ruptured cuticle inconspicuous; paraphyses very few, intermixed with the spores, clavate-capitate to capitate, hyaline, 11–13 × 37–66 μ, average for ten paraphyses 12.5 × 48 μ, stipe solid, hyaline, about 5 μ thick, walls of heads thin, 1–1.5 μ thick, smooth; urediniospores broadly ellipsoid, obovate to subglobose, 15–20 × 17–23 μ, average for forty spores 17.2 × 20.1 μ, walls cinnamon brown, 2–2.5 μ thick, verrucose-echinulate, germ pores eight, in two irregular zones of four pores each, equidistant from the equator, or scattered in the subglobose type.

III. Telia amphigenous and caulicolous, scattered, round, 0.5–1 mm. across, subcuticular, early naked, chocolate brown, ruptured cuticle inconspicuous; paraphyses few, similar to those found in the uredinia; teliospore heads chocolate brown, 5–7 cells across, 50–84 μ, average for forty heads 65.3 μ, 6–14 marginal cells, 6–20 inner ones, heads smooth or with half to two-thirds of the cells bearing a single, wartlike, semihyaline papilla, 1–4 μ long, to each cell; cysts numerous, hyaline, globose, subappressed, in two or three rows, beneath entire head, slowly swelling and bursting in water; pedicel short, hyaline, deciduous.

On Caesalpiniaceae. Type collected on *Cassia covesii* near Tucson, Arizona, by *H. W. Thurston* and *Leslie N. Goodding*, February 26, 1920 (no. 5537 Long); also collected on same host in Sabino Canyon, near Tucson, March 9, 1920, and January 4, 1921, by *Leslie N. Goodding* (nos. 6918 and 6972 Long).

This species is intermediate between *Ravenelia mesillana* and *R. papillifera*. Some of the mounts from the material collected near Tucson (no. 5537) have nearly all of the teliospore heads smooth, while other slides from the same locality, as well as the material collected in Sabino Canyon (no. 6918 Long) in the foothills of the Santa Catalina Mountains, have a large number of the heads papillate.

RAVENELIA SILIQUAE Long

This rust was collected June 1920, at San Antonio, Texas, on the leaves, twigs, branches, and pods of *Acacia farnesiana*. In many cases young pods were found with the uredinia just sporulating, while the leaves and twigs of the same tree showed old uredinia. This proves the writer's contention in a previous article[1] that the twig and leaf rust on this host was *R. siliquae*, which up to that time had only been collected on the pods.

RAVENELIA FRAGRANS Long

A *Ravenelia* collected on the leaves and pods of *Mimosa biuncifera* in Arizona, by *Leslie N. Goodding*, was sent to the writer for identification. A careful comparison of this material with the type of *R. fragrans* shows no essential characters sufficient to warrant making it a new species. The paraphyses in the Arizona rust are slightly more clavate than those found in the typical *R. fragrans*, while many of the teliospore heads are nearly smooth. Each of the papillate cells bears 1–4 hyaline papillae, 1–3 μ long. The stipe is usually short, hyaline, and deciduous, but occasionally one is found which measures up to 100 μ. Many telial heads of the typical *R. fragrans* show cells with few and very short papillae similar to the Arizona material.

This rust has been collected in two localities in Arizona, the Baboquivari Mountains, October 24, 1919 (nos. 6534 and 6535 Long), and Rosemond, December 17, 1920 (no. 6969 Long). The latter collection has a large percentage of the teliospore heads smooth or with only an occasional head showing any papillate cells, while the 1919 material has heads fairly typical of *R. fragrans* as it occurs on *Mimosa fragrans*, yet the two collections are unquestionably the same species.

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[1] Notes on new or rare species of *Ravenelia*. BOT. GAZ. 64:57–69. 1917.

On a recent trip (June 1920) through Texas many areas were revisited which in May and November of 1916 showed an abundance of *Ravenelia* infection of many different species, yet only occasionally was any *Ravenelia* found, although a careful search was made on hundreds of plants which in 1916 were literally covered with *Ravenelia* sori. The species of *Ravenelia* so abundant in 1916 were as follows: *R. siderocarpi*, *R. papillifera*, *R. roemerianae*, *R. mesillana*, *R. gracilis*, *R. leucaenae*, *R. siliquae*, and *Neoravenelia holwayi;* of these only *R. siliquae* was at all common in 1920. This would indicate that certain years are very favorable for the propagation and dissemination of species of *Ravenelia*. This fact, of course, is well known in connection with various species of grain rusts.

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